

ABSTRACT

Rhodamine B is a synthetic dye and is often used by the textile industry. The nature of Rhodamine B is difficult to degrade. Rhodamine B is a synthetic dye that can cause irritation of the digestive tract, impaired liver function and is carcinogenic so that its long-term use can cause cancer. One method to overcome the presence of Rhodamine B is by adsorption and photocatalysis process. Zirconia Oxide (ZrO_2) is a photocatalyst material with a band gap of 4.8 eV. The addition of Fe with a band gap of 2 eV on ZrO_2 aims to reduce the band gap so as to increase the catalytic activity of ZrO_2 . Therefore, the purpose of this study was to obtain Fe-doped Zirconia Oxide (ZrO_2) using the hydrothermal method, determine the characteristics of Fe-doped Zirconia Oxide (ZrO_2), and determine the effectiveness of Fe-doped Zirconia Oxide (ZrO_2) in the Rhodamine B dye adsorption process.

This research begins with the preparation of $ZrOCl_2$ precursor solution, which is then continued with the formation of ZrO_2 by sol-gel method and iron oxide doped ZrO_2 by hydrothermal method. Doping was carried out by hydrothermal method with variations in Fe weight variation (1 and 5 grams). The decrease in dye content was carried out by two methods, namely adsorption and photocatalyst with variations in rhodamine B contact time. The characterizations used in this study are Thermogravimetry Analyzer (TGA), Surface Area Analyzer (SAA), X-Ray Diffraction (XRD), Scanning Electron Microscopy-Energy Dispersive X-Ray (SEM-EDX), Ultraviolet-Visible Diffuse Reflectance Spectroscopy (UV-DRS), and Ultraviolet-Visible Spectrophotometer (UV-VIS).

The mass weight loss obtained from the TGA results was 57.81% on ZrO_2 and 7.09% on $Fe@ZrO_2$. SAA results show that ZrO_2 and $Fe@ZrO_2$ materials are classified as mesopores which have a range of pore size values of 2.7-6 nm. From the results of analysis using XRD, identified Fe successfully doped on ZrO_2 . Based on the results of characterization using SEM-EDX, ZrO_2 and $Fe@ZrO_2$ samples have non-uniform morphology, besides the results of EDX mapping identified Zr and Fe elements in the sample. A decrease in the order of the band gap occurs in both materials (ZrO_2 and $Fe@ZrO_2$) of 2.85 and 1.74 eV, respectively. The results showed that the degradation of rhodamine B dye by Fe-doped ZrO_2 material has a higher percentage of degradation efficiency than ZrO_2 without doping. The results of spectra analysis using UV-Vis spectrophotometer showed a decrease in the percentage of Rhodamine B adsorption from 3.01 on ZrO_2 to 2.34% on $Fe@ZrO_2$ material.

Key words: degradation method, hydrothermal method, photodegradation, rhodamine B, zirconia oxide (ZrO_2), iron oxide (Fe_2O_3).